

**PLAINTIFF'S
EXHIBIT**

WH-974

February 26, 1970

FLAME RETARDANT KRAFT-BASED MICARTA

The following is a report on the physical properties, U. L. fire-hazard ratings, and manufacturing cost of Flame Retardant Kraft-Based MICARTA (F.R.K. Micarta).

F.R.K. Micarta has been developed as a replacement for .050" Asbestos Micarta. F.R.K. Micarta is fully equivalent to 1/16" Standard Micarta in NEMA tests and other physical properties (See Table I). As a U. L. Listed product "bonded to asbestos-cement," F.R.K. Micarta is in the same category as .050" Asbestos Micarta. In the unbonded state, F.R.K. Micarta is comparable to competitors' F.R. grades. From the results in Table II, the ratings for F.R.K. Micarta (as one product) shall be 55, 10, 85-140 (unbonded) and 15, 5, 15 (bonded to ACB).

Listing the product under one comprehensive rating appears to be the best choice. In any event the worst rating is not obscured by averaging the results (See Table III). U. L. insists that the worst ratings be retained. The only way to improve the ratings would be to restrict severely the grades produced. The advantage of listing the product under two or three ratings would be the indication of the difference between backs, prints, and solid colors. I do not foresee any commercial advantage in this approach.

The only significant variations are in the smoke developed (0, 10, or 15) in the bonded state and the flame spread (50 or 55) in the unbonded state.

The complete range of Micarta colors and prints which is currently available is included in U. L. listing. One exception is a "Black" F.R.K. laminate. It would be possible to formulate a black laminate within the scope of the specification as a "solid color" or a "solid color print." The only limitation in decorative surface is in the upper limit of basis weight of the color or print sheet.

- i.e. 123 lbs. 3v. Solid Color
125 lbs. 3v. Solid Color with Subsurface
115 lbs. Print
95 lbs. Print with Subsurface

The thickness of the laminates tested was 1/16" $\pm$.005" for decorative sheet and .045" $\pm$.005" for backs. Approval shall be obtained in the product specification that these thicknesses represent maximums. It shall be permissible to manufacture thinner laminates within the scope of the U. L. listing; e.g., it may be desirable to offer the decorative laminate in .050" thickness and backs as .030".

The 1970 I.C.S. costs below are based on 4' x 8' 96M34 with satin finish.

Cost Per Sq. Ft.

F.R.K., 1/16"	\$.125
F.R.K., .050"	.116
.050" Asbestos Micarta	.233

The F.R.K. costs are based on actual treating and molding conditions used in plant manufacture.

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Table I

Laminate Physical Properties

<u>Test</u>	<u>Specification</u>	<u>Result</u>
Hot Water Hot Wax	NEMA LD 1-2.02 NEMA LD 1-2.03	No effect. Slight dulling on gloss face.
Cigarette Test	NEMA LD 1-2.04 (min. 110 secs.) Lighted Cigarette	Range: 114-153 secs. (2 results). Average 131 s (NOTE: Bonded to ACE - min. — slight dulling o No effect.
Stain Resistance	NEMA LD 1-2.05	Not tested (surface used in 1/16" Standard Micarta.
Immersion in Boiling Water	NEMA LD 1-2.07 Increase in weight not greater than 10%. Increase in thickness greater than 2%; not greater than 10%.	3.6 - 7.0% (nine laminates tested) 5.0 - 9.2% (nine laminates tested)
Time to Blister in Hot Water (93°F)	10 hrs. minimum	All laminates > 13 hrs. N.B. of 30 laminates tested: 1 blistered in 13 hrs. 3 blistered in 22 hrs. 2 blistered in 55 hrs. 24 did not blister in 200
Immersion in Cold Water	Observe time to blister.	35 days — no blisters on laminates tested. Clean slanting break.
(N.B. Consoweld F.R. laminate can be delaminated after 3 wks. in water. Blisters in 50 Only one piece tested.)		
Resistance to Humid Atmosphere	Observe effect of 100% R.H. at 40°C.	35 days. No effect to da
Dimensional Change	NEMA LD 1-2.08 With grain - not greater than 0.5% Cross grain - not greater than 0.9%	Range (6 laminates tested) 0.04 - 0.21 0.27 - 0.54 Avr. 0.11 0.30

Table I (Cont.)

<u>Test</u>	<u>Specification</u>	<u>Result</u>	
Flexural Strength	NEMA LD 1-2.09		
Face in Compression	Lengthwise - not less than 18,000 psi	31,400	32,800
	Crosswise - not less than 18,000 psi	18,400	18,900
Flexural Modulus	NEMA LD 1-2.09		
Face in Compression	Lengthwise - not less than 8×10^5 psi	2.6×10^6 psi	
	Crosswise - not less than 8×10^5 psi	1.8×10^6 psi	
Resistance to Impact	NEMA LD 1-2.15	46 - 50" (seven laminates tested)	
	Greater than 36"		

Table II

Tunnel Test Results

<u>Grade</u>	<u>Basis Weight</u>		<u>Flame Spread Fuel Contributed Smoke Developed (Unbonded)</u>	<u>Flame Spread Fuel Contributed Smoke Developed (Bonded)</u>
90480	95	Solid Color (oven dried)	53.64, 0, 138	12.8, 0, 2.3
90482	105	Solid Color	48.7, 2.45, 84.5	15.4, 8.3, 9.95
90474	123	Solid Color	53.64, 0, 111	15.4, 8.2, 18.4
90492	100	Solid Color with Sub.	59.0, 10.0, 78.4	--
90493	125	Solid Color with Sub.	53.64, 0, 132.5	12.8, 0, 4475
90432	65	Print	43.6, 4.5, 7.05	15.4, 3.4, 8.5
83479	100	Print	51.3, 8.8, 84.0	15.4, 3.3, 16.2
83432	115	Print	43.6, 1.6, 104	15.4, 9.2, 13.4
84420	95	Print with Subsurface	51.2, 0, 110	15.4, 6.1, 9.0
.045" Becks	-	--	48.7, 12.6, 19.8	12.8, 5.1, 0
	-	--	48.7, 11.5, 17.8	15.4, 4.3, 0
	-	--	48.7, 9.9, 14.8	
		Rating	55, 10, 85-140	15, 5, 15
For Comparison (From U.L. list):				
.050" Asbestos Micarta	FN		30, 15, 10	15, 15, 5
Consoweld	FN		55-70, 5, 95-130	20, 0, 5
Formica	FN		30, 0, 30	15, 0, 15
Raymar	FN		45, 5, 35-100	20, 5, 0
Wilson Plastics			50, 0, 65-160	20, 5, 45
Acceptable Values for Most Authorities			Unspec'd.	25, Unspec'd., 25

Table III

The U. L. inspector has verbally offered the following alternative ratings and is awaiting the decision of our choice.

1. Ratings as three separate products:

Prints	Unbonded	50, 5, 70-110
	Bonded	15, 5, 15
Solid Colors	Unbonded	55, 5, 85-140
	Bonded	15, 5, 10
Backs	Unbonded	50, 10, 15
	Bonded	15, 5, 0

2. Rating as one product:

Unbonded	55, 10, 85-140
Bonded	15, 5, 15

3. Rated as two products: (The figures have ^{not} been confirmed by U. L.)

Decorative	Unbonded	55, 5, 85-140
	Bonded	15, 5, 15
Backs	Unbonded	50, 10, 15
	Bonded	15, 5, 0